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REDESCRIPTION OF *CX. CORNIGER* THEOBALD AND ELEVATION OF *CULEX* (*CULEX*) *LACTATOR* DYAR AND KNAB FROM SYNONYMY BASED ON SPECIMENS FROM CENTRAL AMERICA (DIPTERA: CULICIDAE)

DANIEL STRICKMAN AND JONATHAN PRATT

(DS) Walter Reed Biosystematics Unit, Department of Entomology, Walter Reed Army Institute of Research. Current address: Department of Entomology, Armed Forces Research Institute of Medical Sciences, APO San Francisco 96346-5000; (JP) Box 212, Spring Arbor College, Spring Arbor, Michigan 49283.

Abstract.—*Culex* (*Culex*) *lactator* Dyar and Knab is resurrected from synonymy with *Culex* (*Culex*) *corniger* Theobald on the basis of morphological differences in the adult, male genitalia, and fourth-instar larva. Both species are redescribed and illustrated. *Culex lactator* has been collected from Mexico to northern South America at elevations from sea level to 1500 m. Most larval habitats were in direct contact with the ground, in contrast to the container habitats of *Cx. corniger.*

Key Words: Diptera, Culicidae, *Culex, lactator, corniger, coronator, restuans,* taxonomy, canonical variable, discriminant analysis, Central America

Culex (*Culex*) *corniger* Theobald is known from the Caribbean and Mexico to Uruguay (Knight and Stone 1977). It is easily recognized by the unusual form of the larva and the ornamentation on the mesonotum of the adult. We first saw evidence of two forms of the species in Honduras during extensive collecting in many parts of the country. Study of this and other material in the collections of the United States National Museum resulted in the discovery of differences in all stages of two forms of this species in Central America. One form resembled *Cx. corniger* from its type locality in Pará, Brazil, and the other resembled the lectotype (Stone and Knight 1957) of the junior synonym, *Culex lactator* Dyar and Knab from Rincon Antonio, Oaxaca, Mexico. We therefore elevate *Cx. lactator* from synonymy to species status.

METHODS

First, detailed morphological examinations were made of specimens from Mexico to Costa Rica. Once these studies produced clear means of identification, specimens were examined from other parts of the Neotropics to understand the distribution of *Cx. lactator.* Except for material from the type locality, no material of *Cx. corniger* from outside of Central America was examined.

Morphological terminology is defined in Harbach and Knight (1980) with modified terms for the male genitalia taken from Harbach et al. (1983). Abbreviations used in figures were taken from the same references. Color designations were based on color printing process, as outlined in Kueppers (1982) and used previously for mosquitoes by Strickman (1988). The system describes colors as combinations of three of the fol-

lowing hues: Black (B), cyan (C; a deep sky blue), magenta (M; a deep reddish purple), and yellow (Y). Each component of the color mix is expressed as a percentage of the coverage of a white page (e.g. $B_{10}M_{20}C_{99}$ is a sky blue color). To describe a color, an area of the specimen and the appropriate color chart were illuminated with light from tungsten bulbs receiving five volts of electricity. The color on the specimen was then matched by eye to the nearest color on the chart, taking care to examine each color of the chart surrounded by a neutral gray mask. For light yellow, the color charts did not offer enough resolution to describe color observed by eye. In these cases, the color was described as "yellowish." The use of this color system was not intended to replace qualitative color descriptions; instead, it was meant to provide objective measurements of a species which would act as standards for the authors' perception of color.

Material examined was from the United States National Museum. Abbreviations are ♀ for female adult, ♂ for male adult, ♂G for male genitalia, P for pupa, and L for larva.

Canonical discriminant analyses of larvae and pupae were performed in an effort to use combinations of characters to provide better separation than individual characters. The CANDISC procedure in SAS software (SAS Institute Inc., Carey, NC) was chosen for the analyses because of its simplicity and availability. This procedure finds linear combinations of quantitative characters that best separate known classes. Standardized coefficients enabled ranking importance of characters regardless of numerical size. Raw coefficients were used to produce formulas involving characters that were measured on a specimen. The sum of products of characters and coefficients resulted in a single value, the canonical variable, used to separate species. The sensitivity and accuracy, as defined by Griner et al. (1981), of this method of identification were evaluated by calculating the canonical variable value for each specimen, then counting the number of correct identifications.

TAXONOMY

Culex (*Culex*) *corniger* Theobald

Culex corniger Theobald, 1903: 173, Fig. 93 (Pará, Brazil, male type, female); Belkin, 1968: 15 (lectotype designation).

Culex basilicus Dyar and Knab, 1906b: 169 (Arima, Trinidad, female).

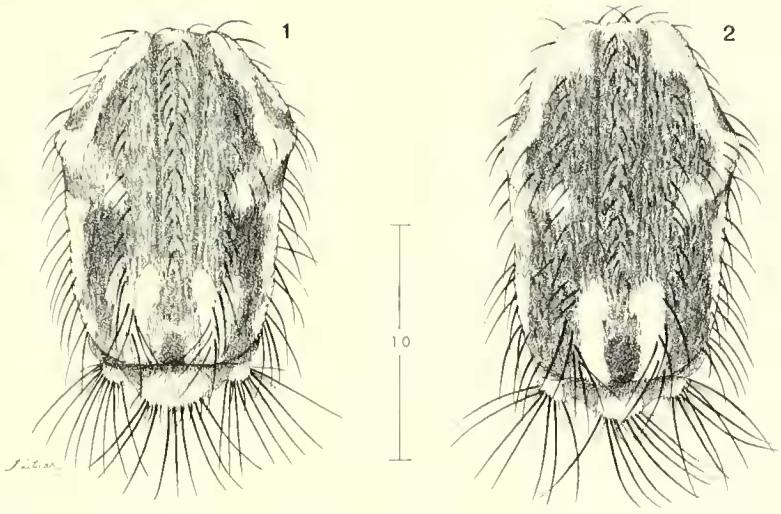
Culex hassardii Grabham, 1906: 167 (Newcastle, Jamaica, male).

Culex subfuscus Theobald, 1907: 403 (Moneague, Jamaica, male).

Culex lactator var. *loquaculus* Dyar and Knab, 1909: 254 (Corozal, Panama Canal Zone, female).

Culex rigidus Senevet and Abonnenc, 1939: 68 (Saut-Tigre, French Guiana, male).

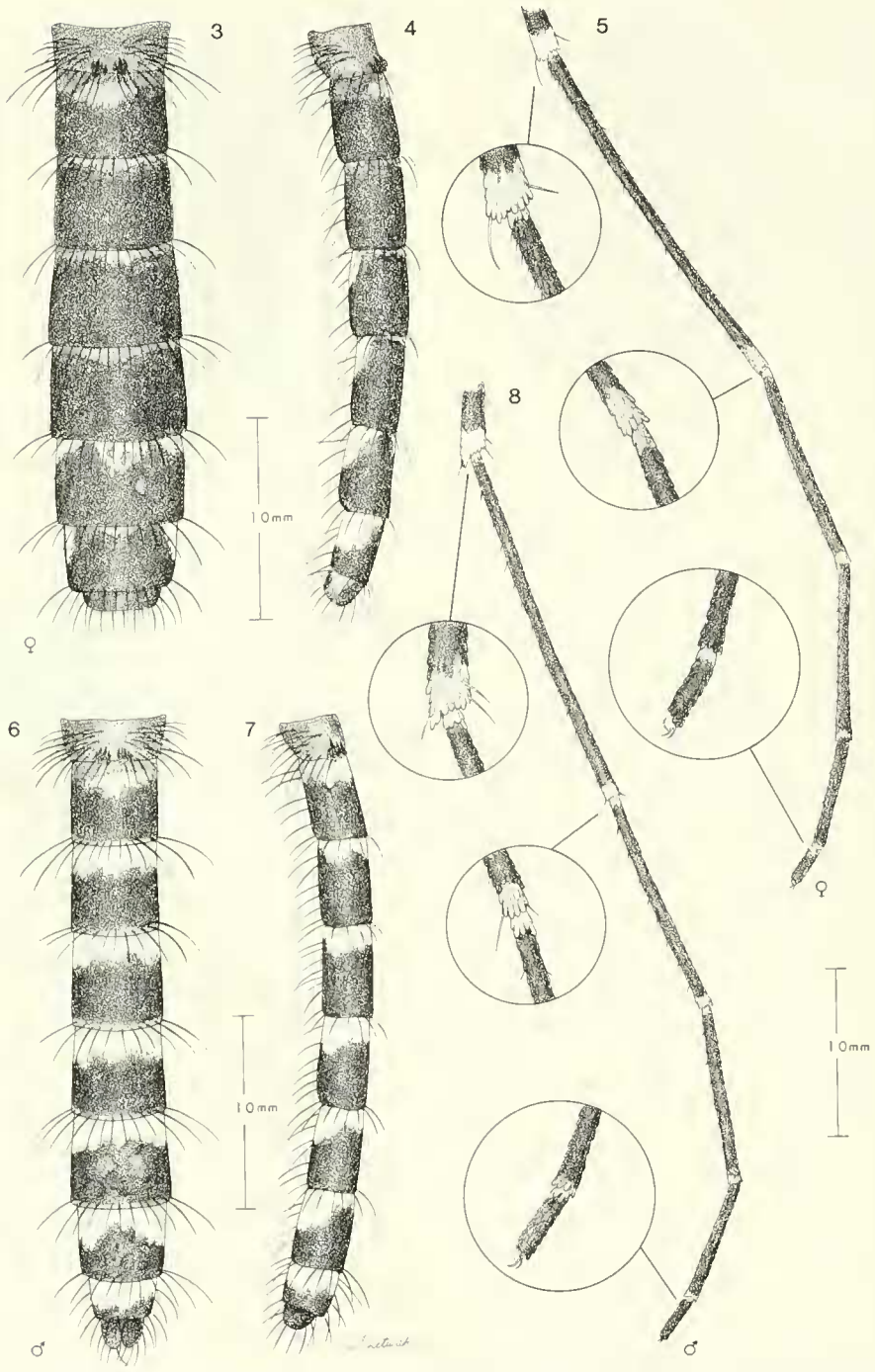
Female (Figs. 2, 3–5).—*Head:* Proboscis black with white band from 0.5 to 0.75 length; band incomplete on dorsal surface, separated by as little as single row of dark scales on either side of channel. Maxillary palpus and clypeus entirely dark. Antennal pedicel without scales, yellowish; first and base of second flagellomere yellowish; remainder black. Vertex with erect narrow scales light medially, dark brown laterally, but sometimes few brown ones; decumbent scales yellowish and white, white on ocular line. Broad white scales on postgena. *Thorax:* Mesonotum as in Fig. 2; light scales yellowish to almost white; background scales dark brown ($B_{90}Y_{90}M_{80}$); bare areas laterad of lateral and posterior scutal fossal and acrostichal scales; bare area at posterior of prescutellar area. Scutellar scales pure white. Lateral of thorax similar to *Cx. lactator* (Fig. 18). Antepronotum with setae over most of surface, narrow dingy white scales on ventral portion. Postpronotum with setae on posterodorsal margin, narrow pale scales along dorsal margin. Proepimeron bare. Proepisternum with numerous setae and sparse to numerous small white scales. Low-



Figs. 1, 2. Dorsal view of mesonotum and scutellum of females from Honduras (WRBU Acc. 1179). 1, *Cx. lactator* (coll. HONC 241-100). 2, *Cx. corniger* (coll. HONC 230-108).

er mesokatepisternum with 1–6 setae and group of dingy white, medium broad scales; upper mesokatepisternum with row of setae and group of dingy-white moderately broad scales; prealar knob with numerous setae and small, translucent scales; pigmentation of integument between scale patches and above middle scale patch conspicuously darker than remainder of sclerite; hypostigmal and postspiracular areas bare, with darkly pigmented integument. Mesanepimeron with up to 4 lower setae, 8 upper setae, and anterior patch of moderately broad, pure white scales; dark pigmentation of integument as on mesokatepisternum. Paratergite without scales. Pattern of pigmentation on integument of pleuron in 2 bands separated by white scale patches. *Legs:* Dark scales similar in color to proboscis. Forecoxa with small patch of light scales dorsally, light ventrally and posteriorly; apical fringe of light scales around segment. Foretibia for most of its length dark dorsally, light ventrally; apical band of light scales around segment. Foretarsus with basal and apical light bands on tarsomeres 1–4, light scales on basal portion of tarsomere 5; bands sometimes very narrow. Midcoxa with translucent scales, light integument. Midfemur dark dorsally and anteriorly, light ventrally and posteriorly; light scales surround segment at base; dark scales surround segment near apex; apical fringe of light scales. Midtibia dark with light scales ventrally and apical band of light scales. Midtarsus similar to foretarsus. Hindcoxa with translucent scales and light integument. Hindfemur dark dorsally; dark area progressively wider apically; dark scales surround segment near apex, light scales surround segment at base; border between light and dark scales near apex roughly a right angle; apical fringe of light scales. Hindtibia dark with light scales ventrally and light apical band 5–6 scales wide. Hindtarsus as in Fig. 5. *Wings:* Scales on costa, subcosta, radius, and bases of other veins brown ($B_{99}Y_{10}M_{30}$) and overlapping. *Abdomen:* Terga as in Figs. 3, 4; basal bands slightly yellowish, whiter laterally; dark scales dark brown ($B_{99}Y_{20}M_{40}$). Sterna V-VII each with complete posterior band of dark scales.

Male adult (Figs. 6–8).—*Head:* Proboscis dark brown with white band surrounding false joint; band complete but on dorsal surface dark scales intrude from apex. Maxil-



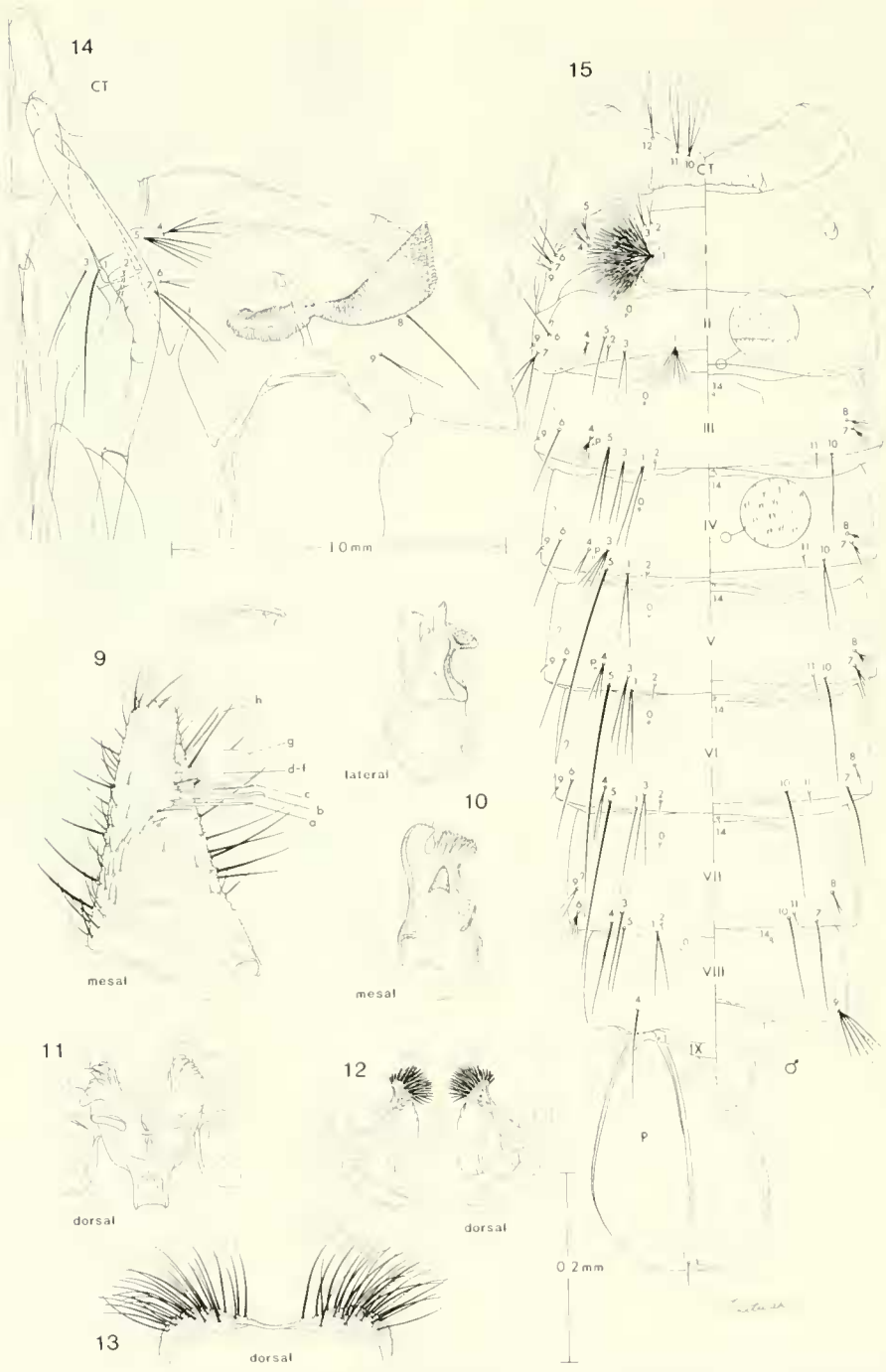
Figs. 3–8. Adult *Cx. corniger* from Honduras (WRBU Acc. 1179; ♀ HONC 230-14; ♂ HONC 230-12). Scale bars do not apply to magnified insets. 3, Female abdomen, dorsal view. 4, Female abdomen, lateral view. 5, Female hindtarsus and apex of hindtibia, anterior view. 6, Male abdomen, dorsal view. 7, Male abdomen, lateral view. 8, Male hindtarsus and apex of hindtibia, anterior view.

lary palpus 1.4 longer than proboscis; dark brown dorsally with light scales on apical 0.5 of palpomere 5 and middle of palpomere 3, narrow light bands at base of 5, base and apex of 3 and 4; ventrally, bright white patches of broad scales on base of 5, just beyond middle and at base of 4; light scales at middle and base of 3. *Thorax:* Light scales usually not as extensively developed on mesonotum as in female. Antepronotum with longer, wider scales than on female. *Legs:* Hindtarsus as in Fig. 8. *Abdomen:* As in Figs. 6, 7; light scales more extensive than in female.

Male genitalia (Figs. 9–13).—*Ninth tergum* (Fig. 13): Shallowly cleft between setose lobes; setae in 3–5 irregular rows, each seta on a small tubercle; integument of lobes aculeate. *Proctiger* (Fig. 12): Basal lateral arm nearly constant in width to tip; base with small mesal, rounded projection; acetabulum prominent; cercal setae 1–5 (mode = 3). *Lateral plate* (Fig. 10): Dorsal process small or absent; lateral lobe prominent, arising from lateral ridge, curving posteriorly along ventral margin, ending in concave rugulose lobe; denticles directed dorsally, tightly packed; individual denticles slightly curved dorsally; ventral arm curved and papery with mesal thickened ridge; dorsal arm short, reaching to or slightly beyond bases of denticles, with pointed or rounded tip. Viewed dorsally in whole mount, lateral lobe and ventral arm form 2 or 3 large lobes with the denticles at their common base. *Gonocoxopodite* (Fig. 9): Surface opposite subapical lobe flattened; integument aculeate, subapical lobe protruded as a tab; seta *a* a slender rod, gently curved at tip, with prominent sclerotized socket at base; seta *b* stouter than *a*, curved and usually recurved at tip, with prominent sclerotized socket at base; seta *c* similar to seta *a*; seta *d–f* small and hairlike; seta *g* on tubercle, foliform, usually with weak striations; seta *h* finer than *a* or *b*, socket much less developed; gonostylus with tip minutely divided, claw trough-shaped.

Pupa (Figs. 14, 15; Table 1).—*Cephalothorax:* Trumpet, median keel, scutum, metanotum, median portions of metathoracic wing, sometimes dorsal portion of mesothoracic wing darker than other areas of cuticle; trumpet dark anteriorly. Trumpet in shape of flattened cone. *Abdomen:* Anteromedian edge of terga I, III, IV, and sometimes terga II, V–VIII, sternum III, and sometimes sterna II–VIII darkly pigmented; lighter pigmentation on median portions of terga, sterna I–III, and sometimes sterna IV–VII; pigmentation progressively light posteriorly from III; surface of tergum I reticulate at 200x; surfaces of terga, sterna II–VIII, genital lobes minutely spiculate; posterior of sternum II with fine spicules; distal 0.5–0.67 of outer margin of paddle minutely spiculate; spot of pigmentation on anterior portion of buttress light, dark, or absent; seta 2-P sometimes absent, very small when present. *Chaetotaxy:* As in Table 1; Figs. 14, 15.

Larva (Fig. 16, Tables 2, 5).—*Head:* More pigmented around mouthparts, on lateralia and collar; antenna slightly darker from seta 1 to tip; mean antennal tuft ratio (distance from antennal base to seta 1-A divided by antenna length) 0.51 (SD = 0.04, min = 0.43, max = 0.62, n = 34). *Thorax:* Integument coarsely spiculate, coarsest on mesothorax but clearly visible on all segments at 40x; support plate of setae 9–12 with minute spines on prothorax, large spines on meso- and metathorax. *Abdomen:* Spiculation finer than on thorax; spicules not visible on all surfaces at 100×; coarse spicules on posterior edge of segment X progressively finer ventrad. *Siphon:* Heavily pigmented on acus, base, spiracular apparatus, spiracular apodeme, and around distal portion of siphon; small projection sometimes visible on basal side of ring formed by spiracular opening of spiracular apodeme; mean spiracular apodeme ratio (length of spiracular apodeme divided by dorsal length of siphon) 0.45 (SD = 0.02, min = 0.42, max = 0.50, n = 33); modal number of



Figs. 9–15. Male genitalia and pupal exuviae of *Cx. corniger*. Drawn from Guatemalan specimen GUA 17-11 (phallosome), Honduran specimen HONC 230-14, WRBU Acc. 1179 (dissected genitalia), and Nicaraguan specimen NI 45-16 (pupa). 9, Gonocoxopodite, mesal view. 10, Lateral plate, lateral and mesal views. 11, Phallosome, dorsal view. 12, Proctiger, dorsal view. 13, Ninth tergal lobes, dorsal view. 14, Pupal cephalothorax (CT), anterior lateral quadrant. 15, Metathoracic wings and abdomen (P = paddle; each magnified inset is 0.05 mm across).

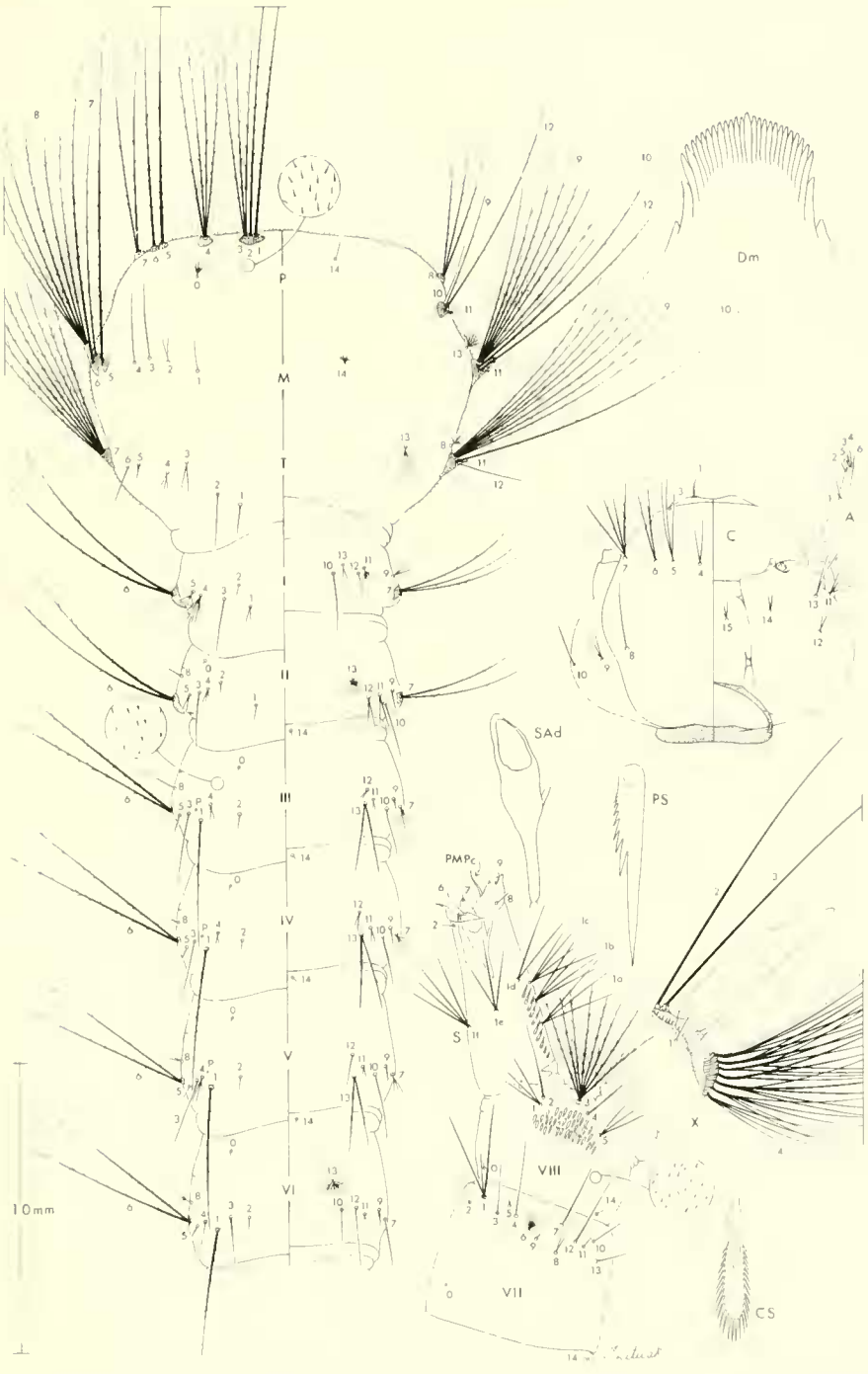


Fig. 16. Larva of *Cx. coronator*, Nicaraguan specimen NI 45-1. Scale does not apply to enlargements of dorsomentum, spiracular apodeme, pecten spine, or comb scale; each magnified inset of spiculation is 0.07 mm across. (A = antenna; C = head; CS = comb scale; Dm = dorsomentum; M = mesothorax; P = prothorax; PMPc = posterior median process; PS = pecten spine; S = siphon; SAd = spiracular apodeme; T = metathorax.)

Table 1. Number of branches of pupal setae of *Culex* (*Culex*) *corniger*. Based on counts made on 10 specimens from 10 collections in Mexico, Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica.

Seta No.	CT	Abdominal Segments I	II	III	IV	V	VI	VII	VIII	IX	Paddle P
0	—	—	1[a]	1	1	1, 2 (1)	1	1	1	—	—
1	1, 2 (1)	7–12 (9)	7–12 (10)	2–7 (2)	2–5 (2)	1–3 (2)	1, 2 (1)	1, 2 (1)	—	1	1, 2 (1)
2	1, 2 (2)	1, 2 (2)	1	1	1	1	1	1	—	—	1
3	1	2	2	2	3–5 (4)	1–4 (1)	1, 2 (2)	1	—	—	—
4	2–4 (2)	2–5 (4)	2, 3 (2)	4, 5 (5)	2, 3 (2)	2–4 (3)	1, 2 (2)	1, 2 (1)	1, 2 (1)	—	—
5	2–4 (3)	2–5 (5)	1, 2 (1)	1–3 (2)	1	1	1	1	—	—	—
6	1, 2(2)	1	1	1	1	1	1	2–5 (3)	—	—	—
7	2	1–3 (2)	1–4 (2)	3–5 (4)	2–4 (2)	2–6 (4)	1	1	—	—	—
8	1	—	1	2–4 (3)	2–4 (3)	2–5 (3)	2, 3 (3)	1–3 (2)	—	—	—
9	1, 2(2)	1–3 (1)	1	1	1	1	1	2, 3 (2)	4–7 (6)	—	—
10	3–8 (4)	—	—	1, 2 (1)	1, 2 (1)	1	1	1	—	—	—
11	2	—	—	1	1	1, 2 (1)	1	1	—	—	—
12	1, 2(2)	—	—	—	—	—	—	—	—	—	—
13	—	—	—	—	—	—	—	—	—	—	—
14	—	—	—	1	1	1	1	1	1, 2 (1)	—	—

[a] Range (mode).

siphon tufts 6 (min = 5, max = 6, n = 33); other quantitative measurements in Table 5. *Chaetotaxy:* As in Table 2, Fig. 16.

Diagnosis.—*Culex corniger* can be distinguished from other members of the subgenus in Central America north of Panama by the following features: *Adult:* Proboscis with light band (though not always completely surrounding proboscis); characteristic mesonotal pattern (Fig. 2); basal and apical light bands on tarsomeres well defined and continuing beyond base of tarsus 3. In female, basal light bands of abdominal terga II–VII not connected laterally to lateral light spots on at least one segment. *Male genitalia:* Ninth tergum shallowly cleft with numerous setae on lobes; lobes connected by thin strap of cuticle; lateral plate of characteristic form (Figs. 10, 11); dorsal process poorly developed; lateral lobe well developed; subapical lobe with setae *a*, *b*, *c*, *d–f*, *g* (foliform), and *h* present; gonostylus narrowed beyond basal 0.3. *Larva:* Antenna not markedly tapered in apical portion; tuft (seta 1-A) with 3 or fewer branches; linear combination of characters (see Discussion) including (in order of importance) saddle index, branches of seta 4-C, siphon index, branches of seta 7-C, ratio of distance to seta 1a-S (from base of siphon) to siphon length, number of pecten teeth, and pecten row length index.

Remarks on types and original descriptions.—We were able to examine type specimens for three of the five remaining synonyms for *Cx. corniger*. *Culex basilicus* Dyar and Knab (from Trinidad, 1906b) (♀ lectotype designated by Stone and Knight 1957), *Cx. hassardii* Grabham (from Jamaica, 1906) (♂ lectotype designated by Belkin et al. 1970) and *Cx. lactator* var. *loquaculus* Dyar and Knab (from Panama, 1909) (♀ lectotype designated by Stone and Knight 1957) all correspond to *Cx. corniger* rather than *Cx. lactator*, based on characters discussed in this paper.

The descriptions for the other two synonyms of *Cx. corniger* indicate their equivalence to that species. The description of *Cx. subfuscus* Theobald (from Jamaica, 1907) includes an illustration of male genitalia showing a strongly developed seta *c* on the subapical lobe, a character of *Cx. corniger*. The male genitalia and other adult characters of *Culex rigidus* Senevet and Abonnenc (from French Guiana, 1939) also correspond to those of *Cx. corniger*, as ac-

Table 2. Number of branches of fourth-instar larval setae of *Culex* (*Culex*) *corniger*. Based on counts made on 11 specimens from 10 collections made in Mexico, Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica.

Seta No.	Head	Thorax			Abdominal Segments								
	C	P	M	T	I	II	III	IV	V	VI	VII	VIII	X
0	—	4–8 (4)[a]	—	—	—	1	1	1	1	1	1	1	—
1	1	1	1	1	2–5 (3)	1	1	1	1	1	2, 3 (2)	3–5 (3)	1
2	—	1	2, 3 (2)	1	1	1	1	1	1	1	1	1	1
3	1	3, 4 (3)	1	1–3 (2)	1	1	1	1	1	1	1	7–10 (8)	1
4	2, 3 (2)	2–4 (4)	1	2–4 (3)	4–6 (5)	3–5 (3)	2–4 (3)	2	2, 3 (2)	1	1	1	6, 7 (7)
5	2–4 (3)	1	1	1	4, 5 (4)	1, 2 (1)	1, 2 (1)	1	1	1	1–3 (2)	2–4 (3)	—
6	2–3 (2)	1	1	1, 2 (1)	2	2	2	2	2	2	5–9 (6)	—	—
7	4–6 (4)	2, 3 (3)	1	7–10 (8)	2–4 (3)	2, 3 (3)	3–6 (5)	4–6 (4)	3–5 (3)	1	1·	1a-S,	3, 4 (4)
8	1	3, 4 (3)	5–8 (6)	4, 5 (5)	—	1, 2 (1)	1, 2 (2)	1–3 (2)	2	1–4 (3)	2, 3 (2)	1b-S,	3, 4 (4)
9	3, 4 (4)	1	6–9 (7)	5–8 (6)	2, 3 (2)	1	1	1	1	1	1–3 (2)	1c-S,	3–5 (3)
10	1	1	1	1	1	1	1	1	1	1	1	1d-S,	2–4 (4)
11	3–5 (3)	3–5 (3)	2–4 (4)	2–6 (3)	4–8 (4)	1, 2 (2)	2, 3 (2)	2	2	2, 3 (2)	1, 2 (1)	1e-S,	3, 4 (4)
12	2–4 (2)	1	1	1	1, 2 (1)	2	2, 3 (2)	2, 3 (2)	1	1	1	1f-S,	4
13	2	—	4–6 (5)	3–7 (4)	2	4–6 (5)	2	2	2	4–7 (5)	1	—	—
14	1, 2 (1)	1	4–6 (5)	—	—	—	1	1	1	1	1	1, 2 (1)	—
15	2–4 (3)	—	—	—	—	—	—	—	—	—	—	—	—

[a] Range (mode).

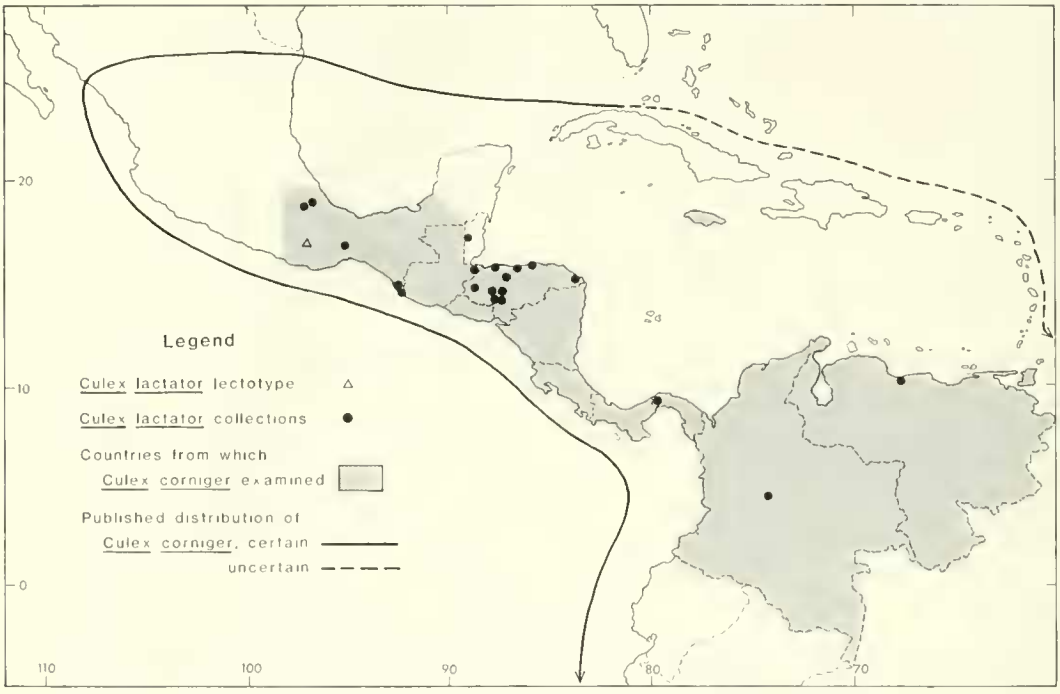


Fig. 17. Geographical distribution of *Cx. lactator* and *Cx. corniger* in northern Latin America.

knowledged by the authors when they later synonymized their species (Senevet and Abonnenc 1958).

We examined specimens of *Cx. corniger* from its type locality, Pará, Brazil. Adults and male genitalia were similar to specimens from Central America. In the original description, Theobald (1903) mentioned characteristics of Central American *Cx. corniger*, including strong mesonotal pattern, incomplete abdominal tergal banding on some segments, and distinct hind tarsal banding.

Distribution (Fig. 17).—According to publications, the distribution of *Cx. corniger* extends from Mexico to Uruguay, including the Caribbean basin. Because our paper is limited geographically to Central America, we can only state with certainty that *Cx. corniger* (as defined here) is present in locations from which we have examined specimens. The distribution of the species in South America may include other species in an unresolved complex (Belkin et al. 1970).

Collection records of specimens examined for this study indicated that the focal distribution of larval *Cx. corniger* includes treeholes, bamboo, and other container habitats. Occasionally, the larvae were found in ground pools. A number of authors have reported these habitats as typical of *Cx. corniger*, including Clark-Gil and Darsie (1983), Belkin et al. (1970), Forattini (1965), and Galindo et al. (1951).

Material examined.—99 ♀ 75 ♂ 64 ♂G 38P 36L from 55 collections. Mexico: Veracruz: Córdoba, 900 m, 14–17 Jul 1964, E. Fisher and D. Verity coll. no. MEX 34 and 41, large treehole, 16 ♀ 8 ♂ 3 ♂G 2P 2L; 800 m, 28 Jul 1965, D. Schroeder coll. no. MEX 237, stream margin with rocks, 4 ♀ 2P 2L; 1000 m, 12 Jul 1965, C. L. Hogue coll. no MEX 380, *Heliconia* flower bracts, 4 ♂ 2 ♂G; 6 Jul 1970, D. and K. Schroeder coll. no. MEX 524, treehole, 3 ♀ 4 ♂ 2 ♂G 2P 2L. Oaxaca: Santa Luereeia, 19 June 1905, F. Knab coll. no. 262, old tank, 6 ♀ 1 ♂ 1 ♂G; Rincón Antonio, 23 June 1905, F. Knab coll. no. 272, trench, 4 ♀ 2 ♂ 1 ♂G; Tehuan-

tepec, 2 July 1905, F. Knab coll. no. 294, tank, 5 ♀ 1 ♂; Alomoloya, 21 Jul 1905, F. Knab coll. no. 312, stream margin rock pool, 1 ♀ 2 ♂ 1 ♂G. Campeche: Campeche, 5 m, 21 Jul 1970, D. and K. Schroeder coll. no. MEX 591, rockhole, 1 ♀ 2 ♂ 2 ♂G 2P 1L; 5 Aug 1970, D. Schroeder coll. no. 602, large rockhole, 2 ♀ 1 ♂ 1 ♂G 2P 2L. Chiapas: Santo Domingo, 815 m, 22 Aug 1987, Strickman, Roberts and Wilkerson coll. no. MX 94, WRBU Acc. 1250, can in cemetery, 12 ♀ 4 ♂ 1 ♂G 2P 2L. Guatemala: Chiquimula: 420 m, 17 Dec 1915, R. Morales, in house, 1 ♀. Guatemala: Guatemala City, 1500 m, 5 Jul 1964, T. J. and J. Zavortink coll. no. GUA 17, hole in cement, 1 ♂G. Retalhuleu: Champerico, <5 m, 2 Jul 1964, V. P. Cowsill coll. no. GUA 21, ground pool, 1 ♂G; San Sebastián, 300 m, 2 Jul 1964, V. P. Cowsill and T. J. Zavortink coll. no. GUAK 29, cut bamboo, 1 ♀ 1 ♂ 2 ♂G. Suchitepéquez: Mazatenango, 380 m, 3 Jul 1964, V. P. Cowsill coll. no. GUA 23, old truck axle, 2 ♀ 1 ♂ ♂G 2P 2L. El Salvador: Sonsonate: Izalco, 430 m, 6 Nov 1971, J. N. Belkin and S. G. Breeland coll. no. SAL 53, treeholes, 1 ♀ 1 ♂ 3 ♂G 2P 2L. Honduras: Atlántida: Río Macora, <5 m, 27 Jul 1985, N. Powers coll. no. HONC 010, WRBU Acc. 1171, stream pool, 9 ♀ 4 ♂ 1 ♂G 2P 2L. Yoro: Río Jalegua, 690 m, 26 Aug 1986, D. Strickman coll. no. HONC 176, WRBU Acc. 1179, crumpled roofing paper, 3 ♀ 5 ♂ 1 ♂G 2P 2L. La Paz: Marcala, 1260 m, 11 Sep 1986, D. Strickman coll. no. 230, WRBU Acc. 1179 military foxhole, 4 ♀ 4 ♂ 1 ♂G 2P 2L. Nicaragua: Chinandega: Corinto, 29 May 1945, 1 ♂ 1 ♂G. Zelaya: Blue Fields, <5 m, 12 Jul 1964, A. Quinonez coll. no. N1 40, ground pool, 1 ♂ 1 ♂G 1P 1L; 13 Jul 1964, coll. no. N1 45, ground pool amid tree roots, 1 ♀ 1 ♂ 2 ♂G 2P 2L; 22 Jul 1964, coll. no. 59, treehole, 1 ♀; 5 m, 25–26 Nov 1971, D. Schroeder coll. no. NIC 101, light trap, 1 ♀. Costa Rica: Alajuela: Alajuela, 880 m, 18 Jul 1971, D. W. Heinemann coll. no. CR 271, 1 ♂; Turrúcares, 650 m, 31 Jul 1971, S. J. Heinemann coll. no. CR 304, rockholes, 1 ♀ 1 ♂ 1 ♂G 1P 2L; 480 m, 31 Jul 1971, S. J. Heinemann and A. Berrios Arias coll. no. CR 308, rockholes, 1 ♀ 1 ♂ 2 ♂G 2P; 3 km E. of San Mateo, 260 m, 1 Nov 1971, D. A. Schroeder coll. no. CR 496, 1 ♀ 1 ♂ 2 ♂G 2P 2L; Ciruelas, 780 m, 4 Nov 1971, D. A. Schroeder coll. no. CR 515, rockhole, 1 ♀ 1 ♂ 2 ♂G 2P 2L. Cartago: Turrialba, 500 m, 23 Aug 1971, D. W. Heinemann coll. no. CR 390, rockholes, 1 ♂. Guanacaste: 10 km NW of Liberia, 60 m, 6 Aug 1964, C. L. Hogue coll. no. CR 187, rockhole, 1 ♀ 1 ♂ 2 ♂G 2P 2L; 23 Jun 1964, coll. no. CR 182, resting on rock, 1 ♀; Alajuelita, 1090 m, 23 Jul 1971, S. J. Heinemann coll. no. CR 284, 1 ♀ 1 ♂ 1 ♂G; coll. no. CR 286, rockhole, 2 ♀; coll. no. CR 285, rockhole, 2 ♀; coll. no. CR 288, rockhole, 1 ♂G; Puerto Humo, 10 m, 20 Jun 1975, J. Hayes coll. no. CR 601, tire, 1 ♀ 1 ♂ 1 ♂G. Limón: Westfalia, <5 m, 4 Dec 1962, C. L. Hogue and W. A. Powder coll. no. 72, 1 ♀; 8 km E. of Zent, 20 m, 17 Dec 1971, D. A. Schroeder coll. no. CR 564, treehole, 1 ♀; Limón, 10 m, 16 Jul 1975, J. Hayes coll. no. CR 610, biting human, 1 ♀. Puntarenas: Cerrillos, 1938, H. W. Kumm coll. no. CRK 599, 1 ♂ 1 ♂G; 7 km E. of Palmar Norte, 40 m, C. L. Hogue coll. no. CR 163, treehole, 1 ♀ 1 ♂ 4 ♂G 2P 2L; 6 km S. of San Vito, 30 Apr 1967, D. F. Veirs, 1

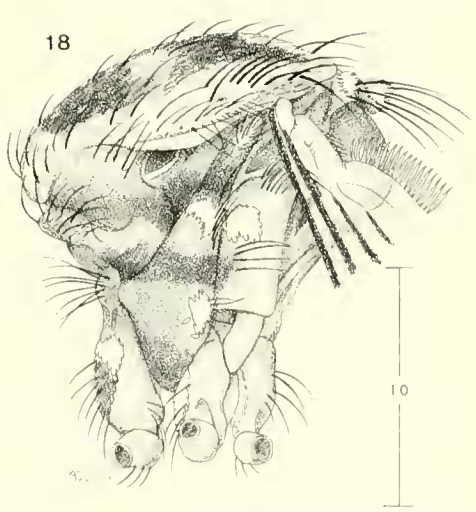


Fig. 18. Lateral view of thorax of ♀ *Cx. lactator* (Honduran specimen HONC 241-100, WRBU Acc. 1179).

♀; Las Loras nr. Puntarenas, 9 Sep 1905, F. Knab coll. no. 334, ground pool, 1 ♂, 1 ♂G. San José: San José, 21 Sep 1905, F. Knab coll. no. 343, barrel, 1 ♀; San Isidro del General, 750 m, 23 Jun 1964, C. L. Hogue coll. no. CR 180, concrete pond, 1 ♀ 1 ♂ 1 ♂G 2P 2L; Santa Ana, 860 m, 25 Jul 1971, A. Berrios Arias and S. J. Heinemann coll. no. CR 293, broken bamboo, 1 ♀ 1 ♂ 1 ♂G; Santa Ana, 1938, H. W. Kumm coll. no. CRK 283, 1 ♀ 1 ♂ 1 ♂G; 4 km E. of San Isidro de Coronado, 1520 m, 30 Jul 1971, D. W. and S. J. Heinemann coll. no. CR 300, ditch, 1 ♀. No location within country: 3 ♂G. Panama: Corozal, USNM Type No. 12050, ♀, lectotype of *Culex lactator* var. *loquaculus*. Jamaica: Kingston, M. Grabham, ♂, lectotype of *Culex hassardii*. Trinidad: F. W. Urich, USNM Type No. 10021, ♀, lectotype of *Culex basilicus*. Brazil: Pará, Apr 1930, N. C. Davis, 11 ♂ 11 ♂G. Representative specimens from Panama, Colombia, and Venezuela were examined.

Culex (*Culex*) *lactator* Dyar and Knab

Culex lactator Dyar and Knab, 1906a: 209, Fig. 23 (Rincón Antonio, Oaxaca, Mexico, larva). RESURRECTED FROM SYNONYMY.

Culex lactator var. *lactator* Dyar and Knab, 1909: 254 (adult).

Culex corniger var. *lactator* Howard, Dyar, and Knab, 1915: 240 (adult).

Culex corniger Theobald, Dyar, 1922: 23 (*lactator* in synonymy).

The following description lists characters of *Cx. lactator* which are different from those of *Cx. corniger*.

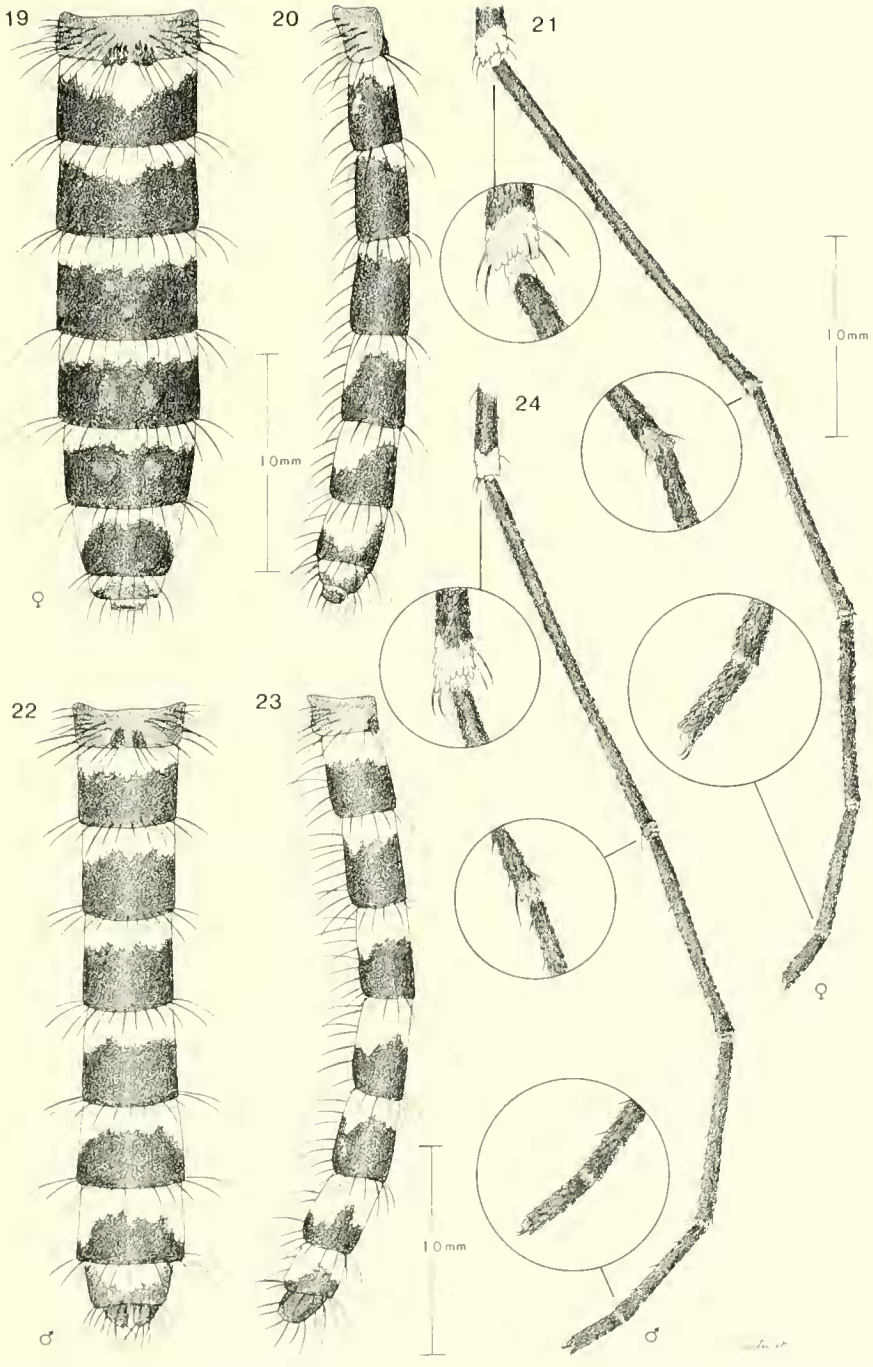
Female (Figs. 1, 18, 19–21).—*Head:* Decumbent scales of vertex yellowish, dingy white on ocular line. Broad dingy white scales on postgena. *Thorax:* Mesonotum as in Fig. 1; background scales dark brown ($B_{90}Y_{70}M_{99}$) adjacent to light areas, on scutal fossa, and along dorsocentral and acrostichal lines; other background scales lighter brown with gold reflection; lateral scutal fossal light scales sometimes four rows wide in anterior portion; or less numerous, causing break in pattern; posterior dorsocentral light scale sometimes few, absent, or isolated so they form spots or sometimes pattern formed by light scales inconspicuous. Scutellar scales narrowest on posterior median part of midlobe. Pleura as in Fig. 18. Antepronotum with narrow yellowish scales on ventral portion. Postpronotum with narrow golden scales along dorsal margin. Procpisternum with sparse, broad, yellowish scales. *Legs:* Foretarsus entirely dark. Midtarsus dark with narrow, poorly defined bands of slightly lighter scales at base and apex of tarsomeres 1, 2, base of tarsomere MT-3. Hindtibia with light apical band 3–4 scales wide. Hindtarsus as in Fig. 21. *Abdomen:* Terga as in Figs. 19, 20; basal light bands reach lateral spots on terga I–VII. Sternum V covered with slightly yellowish scales; VI and VII with posterolateral or complete posterior bands of dark scales.

Male (Figs. 22–24).—Differences from female similar to those listed for *Cx. corniger*.

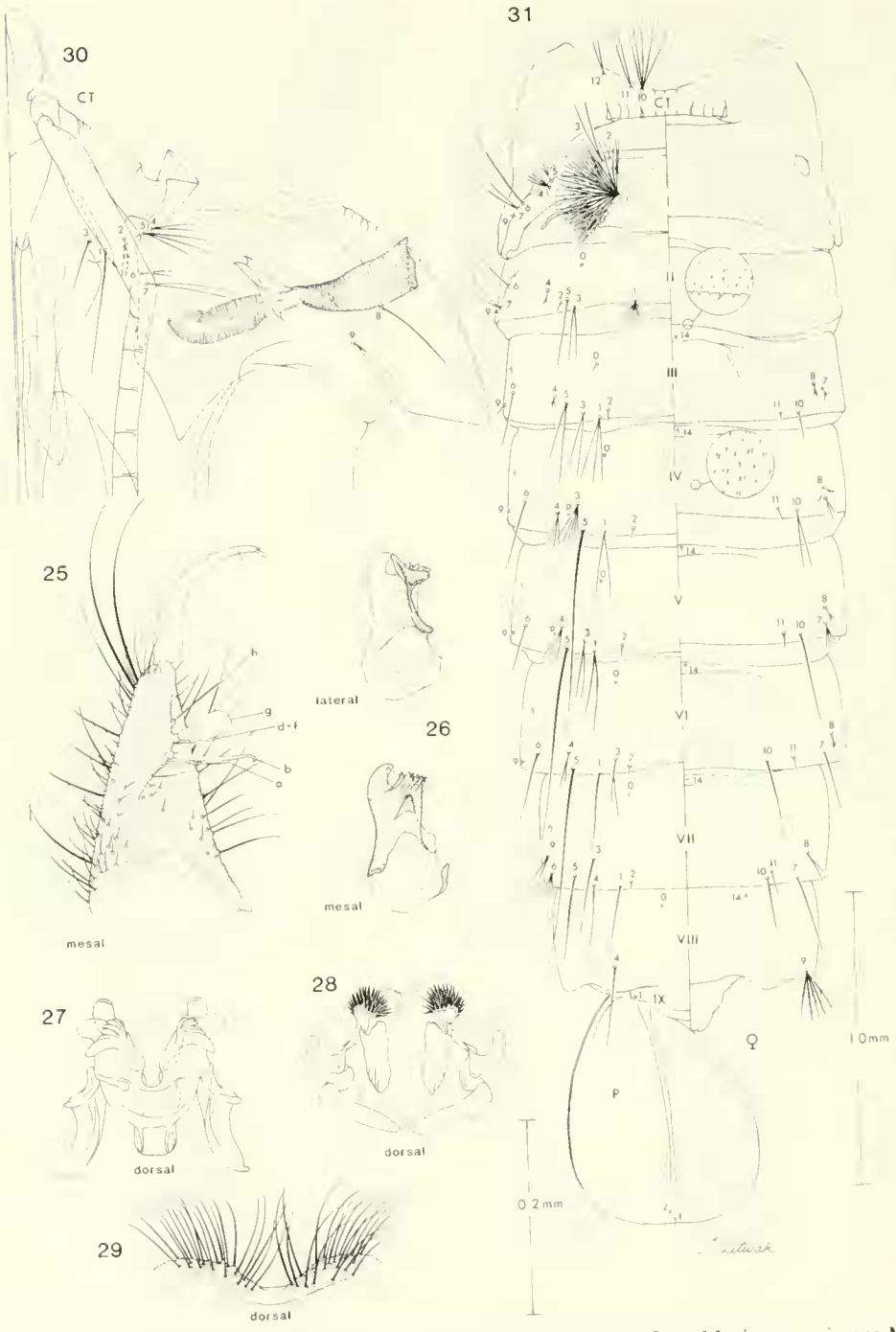
Male genitalia (Figs. 25–29).—*Ninth tergum* (Fig. 29): Tergum deeply cleft between lobes; setae in three or four irregular rows. *Proctiger* (Fig. 28): Basal lateral arm usually narrows slightly, then widens to rounded, excavated tip; cercal setae 2–6 (mode = 3). *Gonocoxopodite* (Fig. 25): Seta *c* only occasionally present (one side of one specimen, both sides of another) as rod much finer than seta *c* in *Cx. corniger*; gonostylus with slightly lumpy outline.

Pupa (Figs. 30, 31; Table 3).—*Abdomen:* Posterior of sternum II with stout spicules. *Chaetotaxy:* As in Table 3; Figs. 30, 31.

Larva (Fig. 32; Tables 4, 5).—*Head:* Antenna gradually darker from seta 1 to tip; mean antennal tuft ratio (distance from antennal base to seta 1-A divided by antenna length) 0.49 (SD = 0.04, min = 0.40, max = 0.59, n = 104). *Thorax:* Spiculation coarser on dorsal and sometimes ventral surfaces of meso- and metathorax; spicu-



Figs. 19–24. Adult *Cx. lactator* from Honduras (WRBU Acc. 1179; ♀ HONC 241-100; ♂ HONC 241-21). Scale bars do not apply to magnified insets. 19, Female abdomen, dorsal view. 20, Female abdomen, lateral view. 21, Female hindtarsus and apex of hindtibia, anterior view. 22, Male abdomen, dorsal view. 23, Male abdomen, lateral view. 24, Male hindtarsus and apex of hindtibia, anterior view.



Figs. 25–31. Male genitalia and pupal exuviae of *Cx. lactator*. Drawn from Mexican specimens MX 19-1 and 19-100, WRBU Acc. 1250 (genitalia) and Honduran specimens HONC 241-19 and 241-20, WRBU Acc. 1179 (pupa). 25, Gonocoxopodite, mesal view. 26, Lateral plate, lateral and mesal views. 27, Phallosome, dorsal view. 28, Proctiger, dorsal view. 29, Ninth tergal lobes, dorsal view. 30, Pupal cephalothorax (CT), anterior lateral quadrant. 31, Metathoracic wings and abdomen (P = paddle; each magnified inset is 0.05 mm across).

Table 3. Number of branches of pupal setae of *Culex* (*Culex*) *lactator*. Based on counts made on 14 specimens from 11 collections in Mexico and Honduras.

Seta No.	CT	Abdominal Segments I	II	III	IV	V	VI	VII	VIII	IX	Paddle P
0	—	—	1	1	1	1	1	1	1, 2 (1)[a]	—	—
1	1, 2 (1)	9–14 (11)	6–14 (10)	2–4 (3)	2, 3 (2)	1–3 (2)	1, 2 (1)	1, 2 (1)	—	1	1–3 (1)
2	2	1, 2 (2)	1, 2 (1)	1	1	1	1	1	—	—	1, 2 (1)
3	1	1, 2 (2)	2	2	3–5 (5)	1, 2 (2)	1, 2 (2)	1	—	—	—
4	2–4 (2)	3–5 (5)	2–5 (3)	3–6 (4)	2–5 (3)	2–4 (3)	1–3 (2)	1, 2 (1)	1, 2 (1)	—	—
5	2–5 (3)	3–8 (3)	1, 2 (1)	1–3 (2)	1	1	1	1	—	—	—
6	1–3 (2)	1	1, 2 (1)	1	1	1	1	2–7 (4)	—	—	—
7	2	2	1–3 (2)	3–5 (4)	2–5 (3)	2–5 (4)	1	1	—	—	—
8	1, 2 (1)	—	—	2–5 (3)	2–4 (3)	2–4 (3)	2–4 (3)	1–3 (2)	—	—	—
9	1, 2 (2)	1, 2 (2)	1	1	1	1	1	2–4 (2)	4–7 (5)	—	—
10	4–8 (5)	—	—	1, 2 (1)	1, 2 (2)	1	1	1	—	—	—
11	2, 3 (2)	—	—	1	1	1	1	1, 2 (1)	—	—	—
12	1, 3 (2)	—	—	—	—	—	—	—	—	—	—
13	—	—	—	—	—	—	—	—	—	—	—
14	—	—	—	1	1	1	1	1	1, 2 (1)	—	—

[a] Range (mode).

lation clearly visible on dorsal side of the mesothorax at 40×, elsewhere at 100×. *Siphon:* Mean spiracular apodeme ratio (length of spiracular apodeme divided by dorsal length of siphon) 0.45 (SD = 0.035, min = 0.36, max = 0.56, n = 107); modal number of siphon tufts 6 (min = 5, max = 7, n = 107); other quantitative larval measurements in Table 5. *Chaetotaxy:* As in Table 4; Fig. 32.

Lectotype (Figs. 33–42).—Includes adult male and associated genitalia, larval and pupal exuviae on slides. *Adult male:* Glued to point with right wing detached and glued separately; right hindleg absent; dark scales faded compared to recently collected specimens (brown $B_{60}Y_{99}M_{80}$ on proboscis, $B_{50}Y_{90}M_{70}$ on hindfemur, $B_{40}Y_{90}M_{80}$ on abdominal terga); some scales of pleuron rubbed off. *Male genitalia:* Includes VI–VIII, cleared but undissected, gonostyli and subapical lobes arranged for easier viewing. Ninth tergum and proctiger have been pushed downward (ventrally) and apically, distorting their relationship with lateral plates. In Fig. 34, ventral arms of lateral plates appear mesad of lateral lobes. *Larva:* Divided at abdominal segment VII, thorax and abdomen twisted. *Pupa:* Good condition.

Diagnosis.—*Culex lactator* can be distinguished from other members of the subgenus in Central America north of Panama by the following features. *Adult:* Proboscis with light band (though not always completely surrounding proboscis); mesonotal pattern characteristic (Fig. 1); bands of tarsi narrow, poorly defined and not extending beyond base of tarsus 3. Basal light bands on abdominal terga II-VII connected laterally to lateral light spots. *Male genitalia:* Ninth tergum deeply cleft with numerous setae on lobes; lobes connected by broad strap of cuticle; lateral plate of characteristic form, dorsal process poorly developed; lateral lobe well developed; subapical lobe with setae *a, b, d-f, g* (foliform), and *h* present; gonostylus narrowed beyond basal 0.3. *Larva:* Antenna not markedly tapered in apical portion; tuft (seta 1-A) with 3 or fewer branches; linear combination of characters (see Discussion) including (in order of importance) saddle index, branches of seta 4-C, siphon index, branches of seta 7-C, ratio of distance to

Table 4. Number of branches for fourth-instar larval setae of *Culex* (*Culex*) *lactator*. Based on counts made on 14 specimens from 11 collections made in Mexico and Honduras.

Seta No.	Head	Thorax			Abdominal Segments								
	C	P	M	T	I	II	III	IV	V	VI	VII	VIII	X
0	—	4–8 (5)[a]	—	—	—	1	1	1	1	1	1	1	—
1	1	1	1	1, 2 (1)	1–4 (2)	1	1	1	1	1	1–4 (3)	2–6 (3)	1
2	—	1	2–5 (2)	1, 2 (1)	1	1	1	1	1, 2 (1)	1	1	1	1
3	1	3, 4 (3)	1	2–4 (2)	1	1	1	1–3 (1)	1	1	1	7–12 (8)	1
4	2–4 (3)	3–5 (4)	1	2–4 (2)	3–7 (4)	2–6 (4)	2–4 (2)	1, 2 (2)	2–4 (3)	1, 2 (1)	1	1	6–8 (7)
5	2–4 (3)	1	1	1	2–6 (4)	1–3 (1)	1	1, 2 (1)	1	1	1–4 (2)	2–4 (3)	—
6	2–4 (3)	1	1, 2 (1)	1	2, 3 (2)	2, 3 (2)	2, 3 (2)	2, 3 (2)	2	2	4–11 (5)	—	—
7	4–9 (6)	2–4 (3)	1–3 (1)	8–12 (9)	3, 4 (3)	2–4 (3)	3–6 (4)	4–6 (4)	3–5 (3)	1	1, 2 (1)	1a-S,	3, 4 (4)
8	1	3, 4 (3)	4–8 (7)	4–9 (6)	—	1	1, 2 (1)	1, 2 (1)	1, 2 (2)	1–5 (3)	1–5 (2)	1b-S,	3, 4 (3)
9	3–5 (4)	1	6–11 (7)	6–11 (8)	2, 3 (2)	1	1	1	1	1	1	1c-S,	2–4 (3)
10	1	1	1	1	1	1	1	1, 2 (1)	1	1	1	1d-S,	2–5 (3)
11	2–4 (3)	2–5 (4)	3–5 (4)	1–6 (4)	4–9 (6)	1–3 (2)	1–3 (2)	1–3 (2)	1–3 (2)	2, 3 (2)	1–3 (1)	1e-S,	2–4 (2)
12	2, 3 (3)	1	1	1	1, 2 (1)	1–4 (2)	1–3 (2)	1–3 (2)	1, 2 (1)	1, 2 (1)	1	1f-S,	2–4 (2)
13	1–3 (2)	—	5–10 (6)	2–4 (3)	2, 3 (2)	4–9 (5)	2, 3 (2)	2	2, 3 (2)	5–9 (6)	1	—	—
14	1, 2 (1)	1	4–9 (7)	—	—	—	1	1	1	1	1	1, 2 (1)	—
15	2–4 (3)	—	—	—	—	—	—	—	—	—	—	—	—

[a] Range (mode).

Table 5. Comparisons of quantifiable larval characters used to distinguish *Culex corniger* from *Culex lactator*. The characters are listed in order of importance.

Larval Character	Mean ± SD (n) and Range	
	Cx. lactator	*Cx. corniger*
Saddle index[a]	2.13 ± 0.14 (106) 1.58–2.59	1.87 ± 0.11 (33) 1.61–2.09
No. 4-C branches[b]	3 (97) 2–4	2 (31) 2–3
Siphon index[c]	1.71 ± 0.21 (108) 1.18–2.48	1.82 ± 0.28 (33) 1.23–2.41
No. 7-C branches[b]	6 (104) 4–9	4 and 5 (33) 4–7
1a-S ratio[d]	0.21 ± 0.05 (108) 0.14–0.60	0.27 ± 0.05 (33) 0.17–0.36
No. pecten spines[b]	9 (108) 6–15	10 (33) 8–13
Pecten row index[e]	0.58 ± 0.05 (107) 0.37–0.73	0.61 ± 0.06 (33) 0.48–0.73

[a] Dorsal length of siphon divided by dorsal length of saddle.
[b] Mode (n) and range.
[c] Dorsal length of siphon divided by width of siphon at base.
[d] Distance from base of siphon to first siphon tuft divided by dorsal length of siphon.
[e] Distance from dorsal base of siphon to last pecten spine divided by dorsal length of siphon.

seta 1a-S (from base of siphon) to siphon length, number of pecten teeth, and pecten row length index.

Distribution (Fig. 17).—We found specimens of *Cx. lactator* in collections from central Mexico to central Colombia. The lack of specimens from Nicaragua and Costa Rica was unexpected, but more thorough collecting in habitats suited to *Cx. lactator* would probably find the species in those countries. The species is apparently absent from the Caribbean. Its distribution in South America is uncertain because the *corniger* group may include undescribed species which resemble *Cx. lactator*. For example, two male genitalia from Ecuador resemble the genitalia of *Cx. lactator*, but because they are not associated with adults, identification is uncertain.

Collections of larval *Cx. lactator* have been made from sea level to 1500 m. The species has usually been found in sunlit water in contact with soil, such as ground pools, stream margins, and lake margins. Most of the sites had been fouled either by natural vegetation or domestic activity. Only one collection was taken from a container, a liter can in a cemetery, but the can rested on the ground and contained rotting vegetation. Although the focal distribution of *Cx. lactator* is distinct from that of *Cx. corniger*, these species occasionally share the same larval habitat (Honduras: HONC 316, WRBU Acc. 1221; Mexico: MEX 237).

Material examined.—Total 150 ♀ 145 ♂ 39 ♂G 163P 110L in 30 collections. Mexico: Oaxaca: Rincón Antonio, lectotype, 23 Jun 1905, F. Knab coll. no. 270i, "Ditch containing a small quantity of very thick and foul water among bones and other rubbish, and swarming with mosquito larvae and pupae.", 1 ♂ 1 ♂G 1P 1L, also in series 5 ♀ 4 ♂ 1 ♂G. Veracruz: Córdoba, 10 Jun 1905, F. Knab coll. no. 258, 2 ♀ 1 ♂ 1 ♂G; 600 m, 26 Jul 1965, D. Schroeder and R. X. Schick coll. no. MEX 235, margin artificial lake, 3 ♀ 1 ♂ 2 ♂G 4P 9L; 1100 m, 28 Jul 1965, D. Schroeder coll. no. MEX 237, stream margin, 1 ♀ 1P 1L; Orizaba, 1300 m, 11 Aug 1965, D. Schroeder and R. X. Schick coll.

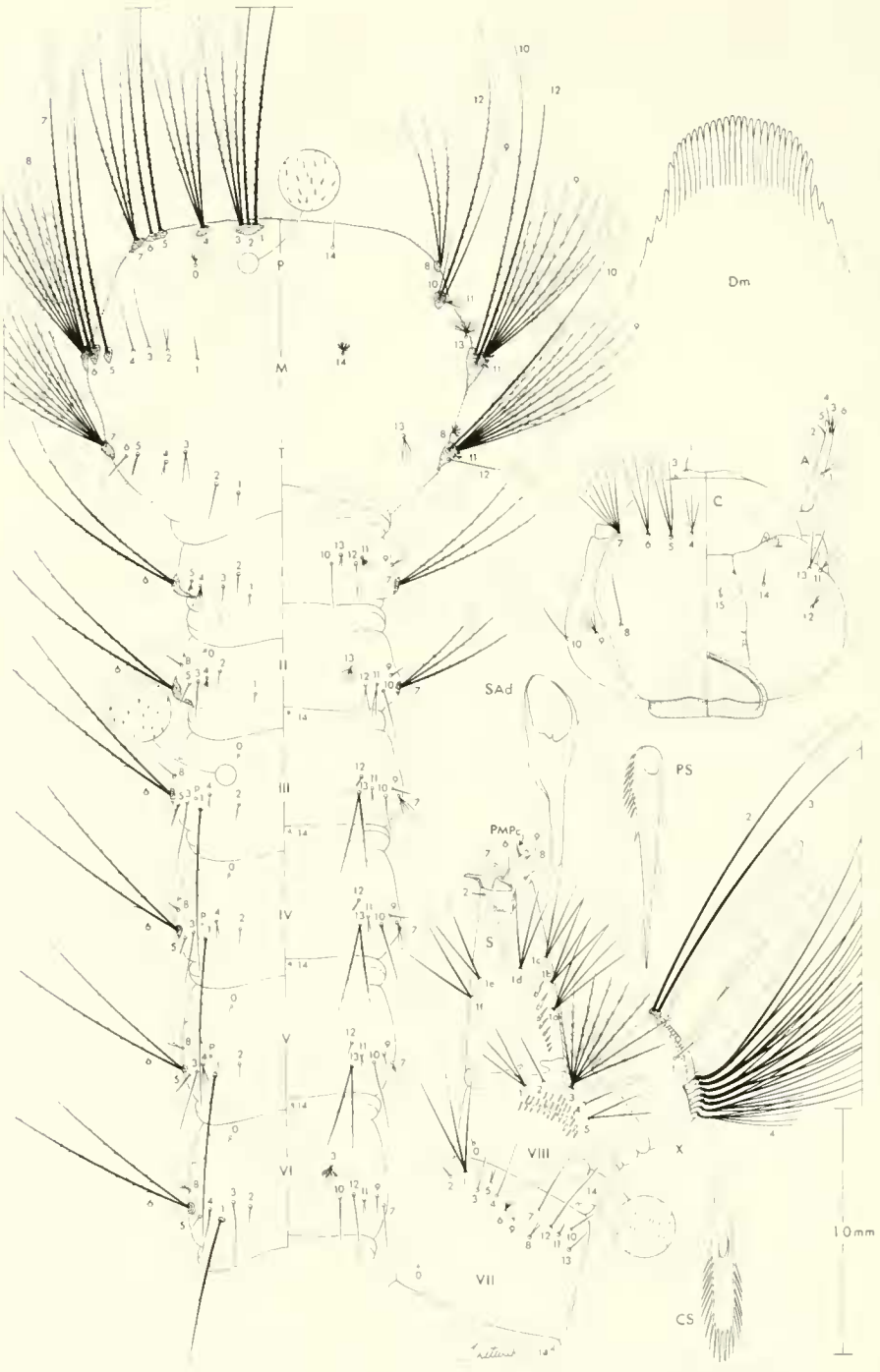
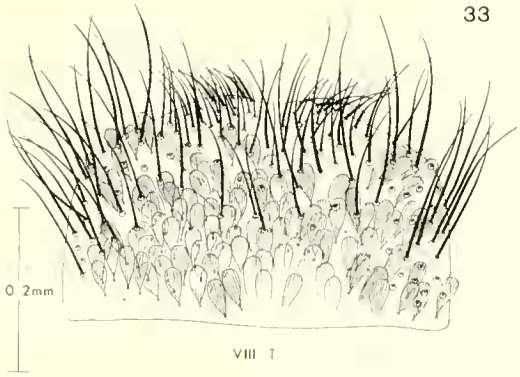
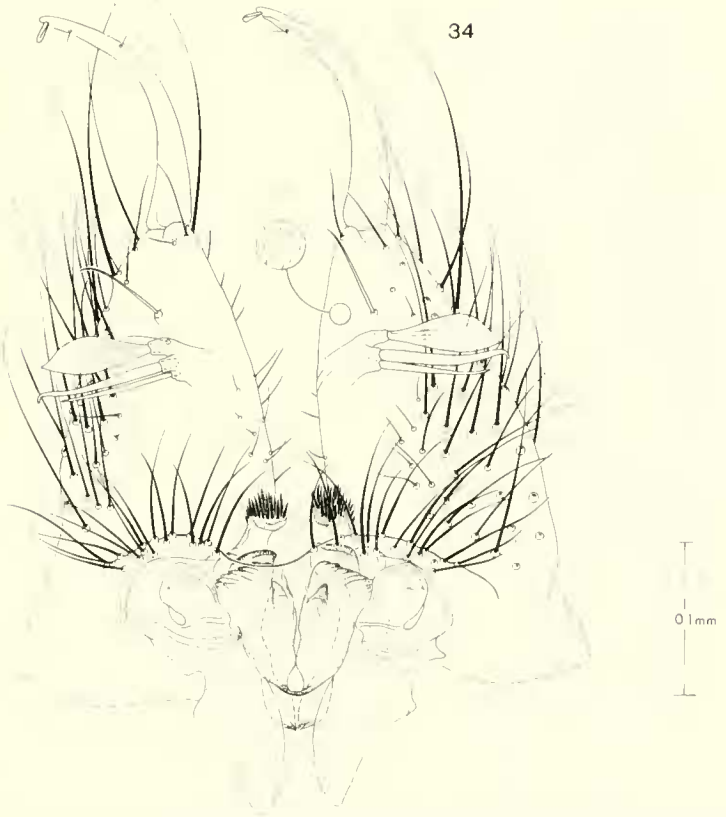


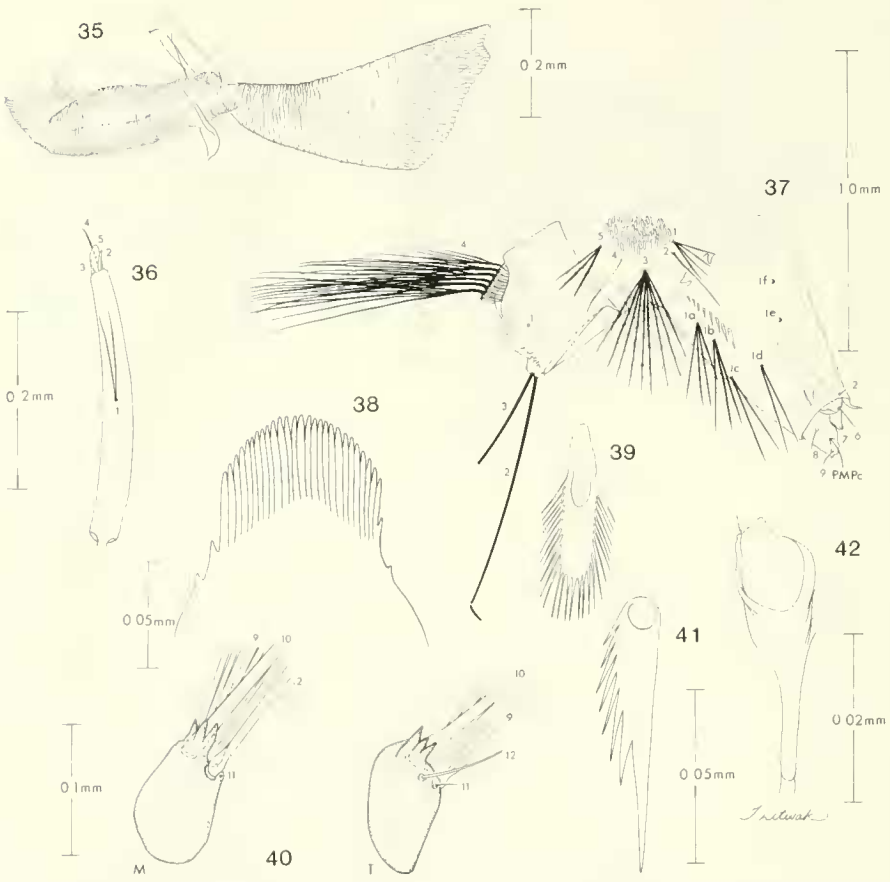
Fig. 32. Larva of *Cx. lactator* Honduran specimens HONC 241-19 and 241-20, WRBU Acc. 1179. Scale does not apply to enlargements of dorsomentum, spiracular apodeme, pecten spine, or comb scale; each magnified inset of spiculation is 0.07 mm across. (A = antenna; C = head; CS = comb scale; Dm = dorsomentum; M = mesothorax; P = prothorax; PMPc = posterior median process; PS = pecten spine; S = siphon; SAd = spiracular apodeme; T = metathorax.)





Figs. 33, 34 Male terminalia of *Cx. lactator* lectotype. 33, Eighth abdominal tergum. 34, Genitalia as they appear on slide mount.

no. MEX 291, concrete pit, 1 ♂ 1 ♂G 1P. Oaxaca: Matías Romero, 200 m, 1 Sep 1965, D. Schroeder coll. no. MEX 335, 2 ♀ 9 ♂ 3 ♂G 12P 16L. Chiapas: El Gancho, sea level, 15 Aug 1987, Strickman, Roberts, and Wilkerson coll. no. MX 19, post hole, 8 ♀ 2 ♂ 4 ♂G 14P 6L; Tapachula, 100 m, 7 Sep 1987, Strickman, Roberts, and Wilkerson coll. no. MX 176, can on ground, 1 ♀ 1 ♂ 1 ♂G. Belize: Cayo: Central Farm, 70 m, 9-10



Figs. 35–42. Details of pupal and larval exuviae of *Cx. lactator* lectotype. 35, Pupal trumpet. 36, Larval antenna. 37, Terminal larval segments. 38, Dorsomentum. 39, Comb scale. 40, Setal support plates for setae 9-12-M and 9-12-T. 41, Pecten spine. 42, Spiracular apodeme with base of posterior median process.

May 1967, D. S. Bertram coll. no. BH A128, light trap, 1 ♂ 1 ♂G. Guatemala: Izabal: Cayuga, 1 ♂G. Honduras: Copán: nr. San Jose de Copán, 12 Mar 1987, D. B. Francy, WRBU Acc. 1254, light trap, 2 ♀ 6 ♂G. Cortés: Puerto Cortés, <5 m, 10 Aug 1967, A. J. Adames coll. no. HON 63, ground pool, 1 ♀ 4P 1L. Atlántida: La Ceiba, 10 m, 18 Jul 1986, D. Strickman coll. no. HONC 92, WRBU Acc. 1179, roadside ditch, 1 ♀ 1P 1L. Yoro: Camp Big Bear, 800 m, 29 Apr 1986, R. Johnson coll. no. HONC 316, WRBU Acc. 1221, shower runoff, 25 ♀ 20 ♂ 1 ♂G 44P 15L. Comayagua: Comayagua, 590 m, 20 Mar 1984, A. R. Gillogly coll. no. HONK 16, WRBU Acc. 1076, stream margin pool, 2 ♀ 1 ♂ 1 ♂G 2P 2L; Palmerola Air Base, 630 m, 23 Nov 1983, J. J. Arnott coll. no. HO 11-1-23, WRBU Acc. 1067, road rut, 23 ♀ 13 ♂ 1P 1L; 6 Jul 1985, N. Powers coll. no. 002, WRBU Acc. 1171, stream margin, 1P 1L; 6 Jul 1985, coll. no. HONC 003, ditch, 2 ♀ 1 ♂ 5P 5L; 17 Jul 1985, coll. no. 006, ditch, 20 ♀ 22 ♂ 3 ♂G 42P 43L; 31 Jul 1986, D. Strickman coll. no. HONC 117, WRBU Acc. 1179, shower runoff, 1 ♀ 2 ♂ 1 ♂G; 31 Jul 1986, coll. no. HONC 118, ditch, 2 ♀ 1 ♂ 1 ♂G; 17 Sep 1986, coll. no. HONC 241, kitchen waste water, 6 ♀ 6 ♂ 1 ♂G 12P 6L; Siguatepeque, 1100 m, 21 Jul 1986, D. Strickman coll. no. HONC 94, WRBU Acc. 1179, 2 ♀ 1 ♂ 1 ♂G 3P 3L. La Paz: Cerro Sosomico, 1200 m, 27 Jul 1986, D. Strickman coll. no. HONC

107, WRBU Acc. 1179, ground pool, 1 ♀. Colón: Puerto Castilla, <5 m, 10 Aug 1964, A. Quinonez coll. no. HO 21, ditch, 4 ♀ 6 ♂ 2 ♂G 8P. Gracias a Dios: Puerto Lempira, <5 m, 17 Jun 1986, D. Strickman coll. no. HONC 27, WRBU Acc. 1179, ground pool, 1 ♀ 1P. Panama: Canal Zone: Summit, 16 Aug 1923, Dyar and Shannon, 5 ♀ 12 ♂ 1 ♂G; 4 May 1935, coll. no. PAX 45, 6 ♀ 15 ♂ 1 ♂G. Colombia: Cundinamarca: Fusagasuga, 1500 m, 3 Mar 1965, A. M. Alarcon and E. Osorno-Mesa coll. no. COB 16, ground pool, 3 ♀ 3 ♂ 1 ♂G. Venezuela: Aragua: Turmero, 500 m, 5 Sep 1966, E. R. Vasquez coll. no. VZ 32, ground pool, 21 ♀ 21 ♂ 4 ♂G 8P 1L.

Discussion

Culex lactator and *Cx. corniger* are similar species which are most easily separated as adults. *Culex corniger* is generally darker with greater contrast between light and dark areas. The dorsum of the abdomen of female *Cx. corniger* has light bands at the base of each segment that became progressively less extensive posteriorly until, at segments V and VI, the bands do not reach the lateral spots. On some specimens only a few light scales are present anywhere on the dorsum of the abdomen. In contrast, females of *Cx. lactator* have broader basal abdominal bands which reach the lateral spots on all segments. There is a marked difference between the two species in the banding on the hindtarsus. *Culex corniger* has distinct light bands on the proximal tarsomeres and less distinct bands on tarsomeres 4 and 5; whereas, *Cx. lactator* has less distinct light bands on the proximal tarsomeres and bands either absent or reduced to a few scales on tarsomeres 4 and 5.

In the male genitalia, *Cx. corniger* differs from *Cx. lactator* in the consistent presence of a moderately stout third rod (seta *c*) proximal to the leaf (seta *g*), a gonostylus that narrows less markedly in its apical two thirds, and a thinner, less deeply cleft connection between the lobes of the ninth tergum. The lateral plates of the two species are very similar. The rare presence of seta *c* in *Cx. lactator* (in 2 of 39 examined) places some doubt on the diagnostic usefulness of this character; however, in both cases seta *c* was markedly weaker than in *Cx. corniger*.

The larvae of *Cx. corniger* and *Cx. lactator* share the same distinctive form of head and siphon. Seven characters enabled separation of some, but not all, of the specimens examined (Table 5). Although the saddle index could be used to identify many of the specimens, separation of species was improved by using combinations characters (Table 6). Each character was multiplied by a coefficient that weighted it according to its importance in separating the species. The sum of the products yielded the canonical variable (CNV), the value of which determined the species identification. The formula below was arranged so that the characters appear in their order of importance (i.e. the first character is the one which would provide the best separation by itself, the second character would separate the next largest number of specimens, etc.). Use of fewer characters simply requires elimination of products beginning from the right side of the formula.

$$\begin{aligned} CNV = {} & 5.45(A) + 0.74(B) - 2.07(C) \\ & + 0.36(D) - 4.42(E) \\ & - 0.15(F) - 3.50(G) \end{aligned}$$

where:

A = saddle index (dorsal length of siphon/dorsal length of saddle)
B = branches of seta 4-C
C = siphon index (dorsal length of siphon/width of siphon at base)
D = branches of seta 7-C
E = base of siphon to insertion of seta 1a-S/dorsal length of siphon
F = number of pecten teeth
G = pecten row length index (dorsal base of siphon to apical pecten tooth/dorsal length of siphon).

Determination of specimens not included in the original analysis supported the use of the canonical variable. Both the lectotype

Table 6. Canonical variable (CNV) values separating *Culex lactator* and *Cx. corniger* based on the use of one, two, three, or seven characters. Use of 4–6 characters was no more accurate than use of three characters. Specimens examined were from Central America.

Species	Statistic	No. of Parameters			
		7[a]	3[b]	2[c]	1[d]
Cx. lactator	CNV cutoff[e]	>6.25	>9.25	>12.75	>11
	Sensitivity[f]	96%	93%	91%	84%
	Mean CNV	8.11	10.28	13.79	11.61
	CNV range	5.25–10.25	7.84–12.18	10.81–15.85	8.61–14.12
Cx. corniger	CNV cutoff	≤6.25	≤9.25	≤12.75	≤11
	Sensitivity	97%	93%	90%	88%
	Mean CNV	4.98	8.04	11.78	10.19
	CNV range	3.25–7.25	6.70–9.47	10.74–12.87	8.77–11.39
Both	Accuracy[g]	96%	93%	90%	85%

[a] CNV = 5.45(saddle index) + 0.74(branches of seta 4-C) − 2.07(siphon index) + 0.36(branches of seta 7-C) − 4.42(base of siphon to insertion of seta 1a-S/dorsal length of siphon) − 0.15(number of pecten teeth) − 3.50(pecten row length index).
[b] CNV = 5.45(saddle index) + 0.74(branches of seta 4-C) − 2.07(siphon index).
[c] CNV = 5.45(saddle index) + 0.74(branches of seta 4-C).
[d] CNV = 5.45(saddle index).
[e] Optimum value of CNV to accurately distinguish the most specimens of each species.
[f] Sensitivity = percentage correctly identified out of total examined of that species.
[g] Accuracy = percentage of both species correctly identified out of total examined.

(CNV = 7.28) and specimen VZ 32-62 from Venezuela (CNV=7.33) were well within the range of CNV values (Table 6) for *Cx. lactator*. Collection MEX 237 from Mexico included adults of both *Cx. corniger* and *Cx. lactator*. Associated larval exuviae yielded canonical variable values that corresponded to identifications of the adults: MEX 237-41, CNV = 5.82; MEX 237-93, CNV = 5.29; MEX 237-95, CNV = 7.20.

At a practical level, use of all seven characters would rarely be necessary. The ninety percent accuracy possible using a CNV calculated from a combination of the saddle index and seta 4-C (two parameters in Table 6) would probably be adequate for most purposes, especially since usually only one of the species would be collected from a single site.

A similar discriminant analysis was performed for pupae of the two species (152 specimens of *Cx. lactator*, 35 of *Cx. corniger*). Although statistically significant ($P < 0.01$) separation was achieved, accuracy was only 83%, even using seven characters. We do not consider this level of accuracy sufficient for useful identification. The stouter spiculation on the posterior of sternum II in *Cx. lactator* versus the finer spiculation in *Cx. corniger* separates most specimens, but it is difficult to evaluate specimens without comparative material.

Of the other species in Central America that have adults with banded hindtarsi, only *Cx. coronator* Dyar and Knab and *Cx. restuans* Theobald might be confused with *Cx. lactator* or *Cx. corniger*. *Culex coronator* may be identified by a weakly developed mesonotal pattern and strongly developed banding on the hindtarsus, particularly on tarsomere 5. *Culex restuans* sometimes closely resembles adults of *Cx. lactator*, but the mesonotal pattern is weaker anteriorly and the hindtarsal banding is wider and extends to the base of tarsomere 5 (Strickman and Darsie 1988).

Conclusion

The wide distribution and morphological variability of *Cx. corniger* led to the naming

of five species and one variety which were later synonymized. We have found that one synonym, *Cx. lactator*, represents a species that is distinguishable in all stages but the pupa from sympatric populations of *Cx. corniger*. For this reason, we have elevated *Cx. lactator* to species status.

The previous descriptive literature on *Cx. lactator* was inadequate to identify the species. Dyar and Knab's (1906a) original description of this species was part of a revision of *Culex* larvae which did not include *Cx. corniger*. Of the seven collections cited by Dyar and Knab (1906a), two (from Córdoba and Rincón Antonio) were *Cx. lactator* and five (from Santa Lucrecia, Tehuantepec, Almoloya, Puntarenas, and San Jose) were *Cx. corniger*. The various adult forms were later organized into varieties, culminating in the short key by Howard et al. (1915). Dyar and Knab evidently never associated *Cx. lactator* with its male genitalia, because they illustrated descriptions of *Cx. corniger* with genitalia of *Cx. lactator* in two publications (Howard et al. 1912, Dyar 1928). Fortunately, certain identification is possible since the male prepared by Knab and selected by Stone and Knight (1957) as the lectotype of *Cx. lactator* has associated larval and pupal exuviae as well as genitalia.

Subsequent treatments of *Cx. corniger* in Central America gave little indication of a separate form corresponding to *Cx. lactator*. Lane (1953) mentioned that seta *c* is sometimes absent on the subapical lobe of the male genitalia, but Forattini (1965) and Bram (1967) did not describe this variation. Clark-Gil and Darsie (1983) did not examine male genitalia and their key characters for females and larvae fit both *Cx. corniger* and *Cx. lactator*. Only Martinez Palacios (1950) discussed the two forms, stating that the form lacking seta *c* (i.e. *Cx. lactator*) was the more common and that it was widespread throughout the Neotropical part of Mexico.

In spite of the possibility that the differences between *Culex corniger* and *Cx. lactator* are environmentally induced (making the two forms non-genetic ecophenotypes), we believe that they are closely related, distinct species. The two collections of both species from the same larval habitat support this view. Separate species status may eventually require confirmation through crossing, rearing in artificially adjusted habitats, or chemical genetic studies. For the time being, recognition of *Cx. lactator* as a separate species will facilitate accumulation of data on this form.

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